COMPARATIVE NATURAL HISTORY OF TWO SYMPATRIC POPULATIONS OF PHOLISTOMA (HYDROPHYLLACEAE)

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The generalization that similar species are allopatric has stood the test of numerous systematic studies. It is usually assumed that it is competition which makes the ranges of these species mutually exclusive. Occasionally populations of two similar species can be found growing together at the same site. Such sympatric occurrences provide an ideal opportunity to test the assumption and to look for influences of one population on another. In addition, sympatric occurrences may help us recognize features of each population which provide for their continued reproductive independence.

The object of the study was to investigate a site where two closely related species of *Pholistoma* were found growing together. Constance (1939) has shown by careful morphological study that *P. racemosum* (Nutt.) Constance and *P. auritum* (Lindl.) Lilja. are far more similar to each other than to any other taxa, and has segregated the two out of the genus *Nemophila* and placed them in *Pholistoma*. The other taxa in *Pholistoma, P. membranaceum* (Benth.) segregated out of the genus *Ellisia,* and *P. auritum* var. *arizonicum* (M. E. Jones) were not considered in this study.

Pholistoma auritum var. *auritum* and *P. racemosum* are allopatric throughout most of their range. *Pholistoma auritum,* which has larger purple flowers, is found in the coast ranges of California from San Diego north to Lake Co., in the Sierra Nevada foothills from Calaveras Co., to Kern Co., and on Santa Catalina, San Clemente, and Santa Cruz islands. *Pholistoma racemosum,* with small white flowers, is found in northern Baja California, San Diego Co., and on the off-shore islands of Baja California and California. The one know site where they do occur together (Raven, 1963) is at the base of a large rock outcrop in Little Sycamore Canyon near the west end of the Santa Monica Mountains, Ventura Co. The site is moist, and is characterized by morning and evening fog tending to make a more equable climate than other such woodlands in the Santa Monica Mountains.

The two species differ greatly in their breeding systems. Greenhouse culture showed *P. racemosum* to be autogamous while *P. auritum* is self-compatible but does not set any seed unless artificially self-pollinated. *Pholistoma auritum* is kept from self-pollinating by two mechanisms: protandry, and the fact that the inflorescence rarely has more than one flower shedding pollen at a time. The next flower on the inflorescence usually does not open until 1–3 days after the previous flower has opened. Although the flowers of *P. auritum* have no perceptible odor, they have 5 yellow nectaries which were conspicuous when the flower first opened but faded within one day.

Field studies confirmed that *P. auritum* was predominantly outcrossed and *P. racemosum* inbred. *Pholistoma auritum* was regularly visited by pollinators, usually between 0900 and 1100, which was shortly after the flowers opened and while pollen was being shed. The bees removed almost all of the pollen before noon, at which time the stigmas elongated and became receptive. Observation of pollinators was made during the time of maximum flowering from 0700 to 1400 on 16 April 1966 and from 1630 to 1800 on 13 April 1966. No pollinators were observed visiting *P. racemosum* during the time of maximum flowering. Observations were made between 1300 and 1900 on 30 March 1966 and 0530 to 1300 on 2 April 1966. In addition, *P. racemosum* lacked any regular time of opening, although it tended to open in the late afternoon.

No hybrids were found between *P. auritum* and *P. racemosum* although individuals of the two species were growing just a few feet from each other. The absence of hybrids may be partly due to a difference in flowering time. *Pholistoma racemosum* bloomed earlier than *P. auritum* during 1966. The first flower of *P. racemosum* opened about 15 March 1966; maximum flowering was two weeks later, capsules were formed and the plants were beginning to dry about 16 April 1966. *Pholistoma auritum* opened for the first time on 2 April 1966; maximum flowering occurred two weeks later, the capsules matured and the plants were dying by 11 May 1966.

The two species also differed in microhabitat. *Pholistoma racemosum* occupied areas receiving much less direct sunlight than the areas in which *P. auritum* was found. The densest clusters of *P. racemosum* occurred on the N slope of the rock outcrop where it received direct light for only about 20 minutes each day. The next densest clusters were on the N sides of rocks and trees on the NW slope of the rock outcrop, and received about 2 hours of sunlight during each day. In contrast, *P. auritum* was found on the SW slopes leading away from the rock outcrop, and received direct sun most of the day. Early in the year, *P. auritum* also occurred on the NW slopes, but almost all of these plants died before flowering. In addition, the sites occupied by *P. racemosum* were characterized by shallow soil, little leaf litter and few other plants, whereas sites occupied by *P. auritum* were characterized by deep soil, considerable litter, and much other vegetation.

An examination of herbarium specimens of *P. racemosum* and *P. auritum* var. *auritum* showed that the plants in the study area do not differ morphologically from those in other parts of the ranges. Flowering dates also seem to be the same and the populations do not differ chromosomally. Cave and Constance (1942;1957;1959) have reported both species to be $\mathbf{n} = 9$. The chromosome numbers of plants from both species from the study site are also $\mathbf{n} = 9$. (*P. auritum, Bartholomew 023,* LA; *P. racemosum, Bartholomew 015,* LA).

A study of the two sympatric populations of *Pholistoma* has led me

to the following conclusions. The two species growing together in Little Sycamore Canyon occupy sufficiently different microhabitats so that they are not in direct competition. Their breeding systems are sufficiently different so that they do not even compete for the same pollinator. The two sympatric populations show no differences from other populations of their species, so that neither character displacement nor introgression have occurred. Thus, the normally allopatric distribution cannot be attributed to competitive exclusion, rather the populations must be though of as ecologically quite different, and it is this difference which causes their difference in geographical distribution.

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Literature Cited

Cave, M., and L. Constance. 1942. Chromosome numbers in the Hydrophyllaceae. Univ. Calif. Publ. Bot. 18: 205–216; 1947. III. 18:449–465; 1959. V. 30:233–257.

Constance, L., 1939. The genus Pholistoma Lilja. Bull. Torrey Club 66:341–352.

Raven, P. H., 1963. A flora of San Clemente Island, California. Aliso 5:289–347.

A PRELIMINARY REPORT OF THE MYXOMYCETES OF CRATER LAKE NATIONAL PARK, OREGON

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Crater Lake National Park is located in southeastern Oregon where volcanic activity and glaciers shaped the surrounding mountains and valleys. During the winter months the park is noted for an abundance of snow accumulation, often exceeding 50 feet of measured depth from November to May. The average annual precipitation is about 70 inches. In contrast, the summer is quite dry since very little rain falls during the months of July and August. The flora in the park must withstand the extreme weather conditions in order to survive. It is common to observe living trees bent from the shifting snow. In many places the forest floor is covered with broken limbs and fallen trees.

Slime molds or Myxomycetes are characteristically associated with moist areas on decaying organic matter such as duff, wood, bark, and fallen twigs. An ideal habitat for slime molds is formed on the fallen logs and forest litter dampened by the large amount of water from the melting snow.

The collections for this report were obtained during the summers of 1966 and 1967. The 43 species, listed here, were collected in the field on some form of decaying wood or duff at altitudes from 4,000 to 7,500 feet. At least one collection of each species has been deposited in the University of Iowa Herbarium, Iowa City, Iowa and where possible, du-